



Australian Government

Department of Defence

WOOMERA TEST FACILITY CAPABILITY BRIEF



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1 INTRODUCTION

1.1 PURPOSE

The purpose of this Capability Brief is to present an overview of the aerospace Test and Evaluation (T&E) capabilities that can be offered to prospective users of the Woomera Test Facility (WTF) in South Australia. The brief has been prepared by BAE Systems Australia¹ in consultation with the Royal Australian Air Force (RAAF) Aerospace Operational Support Group (AOSG) who operate and manage the WTF (also referred to as the Woomera Range).

1.2 SCOPE

The brief contains a descriptive overview of the WTF including organisational responsibilities, primary attributes, capability sectors, examples of trial activities, details concerning test areas and instrumentation, available infrastructure and services, and guidance concerning applying to AOSG to use the WTF.

The latest version of this brief is available for download from the Woomera website at www.woomera.com.au/range/downloads.htm together with [Policy and Procedures for the Use of the Woomera Prohibited Area and Woomera Test Facility](#) promulgated by the Department of Defence.

1.3 STRUCTURE

This document is organised as follows:

[Section 1](#) contains the purpose, scope and structure of the brief.

[Section 2](#) provides an overview of the WTF including attributes, capabilities and applications.

[Section 3](#) describes facilities at the Woomera Rangehead and associated Range instrumentation.

[Section 4](#) summarises test areas within the WTF.

[Section 5](#) details support infrastructure available to Range users.

[Section 6](#) summarises services available from support organisations.

[Section 7](#) outlines the process for applying to use the WTF.

[Section 8](#) contains summary remarks pertaining to the WTF.

[Annex A](#) contains a list of Abbreviations and Reference Documents².

[Annex B](#) lists contact details and website links for key personnel and organisations.

[Annex C](#) presents examples of Defence and non-Defence trial activities conducted at the WTF.

¹ BAE Systems Australia is the Commercial Support Contractor to the Department of Defence at Woomera, and is responsible for providing on-site services in Woomera Village and at Woomera Airfield, and also supporting Defence in the development of new trial-related business at the WTF.

² Reference Documents are referred to in the text as RD1, RD2 etc.

2 OVERVIEW OF THE WTF

2.1 HISTORY

The WTF corresponds physically with the Woomera Prohibited Area (WPA) which was established in 1947 under the Anglo-Australian Joint Project to support the testing of British and Australian short and long range missiles (refer to detailed history in [RD1](#) and supplementary information in [RD2](#)). Extensive military trials were conducted at various ranges and launch areas within the WPA prior to the termination of the Joint Project in 1980. Major activities included the testing of ground to air and air to ground weapons (eg *Bloodhound*, *Thunderbird*, *Rapier* and *Blue Steel*), suborbital re-entry experiments involving the British *Black Knight* and US *Redstone* rockets, and development of the Australian *Jindivik* pilot-less target aircraft and *Ikara* anti-submarine weapon.

Numerous space-related activities were also undertaken at Woomera from 1957 onwards. Notable achievements included the launch of over 260 British *Skylark* sounding rockets, support of the *Mercury* manned spaceflight missions, the establishment and operation of the NASA Deep Space Instrumentation Facility at Island Lagoon between 1960-1972, and the launch of the Australian *WRESAT* spacecraft in November 1967 and the British *Prospero* satellite in October 1971. The European Launcher Development Organisation (ELDO) program between 1962 to 1970 was by far the largest space activity undertaken at Woomera, but failed to successfully place a satellite into orbit.

The Joint Defence Space Communications Station Nurrungar, later re-named the Joint Defence Facility Nurrungar (JDFN), was established south of Woomera Village in 1970 and operated until September 1999. JDFN was one of several ground stations controlling geostationary US Defense Support Program (DSP) satellites that provide early detection of missile launches and nuclear detonations.

Over the past decade, the WTF has been used increasingly for a wide range of ground, air and space trials involving the Australian Defence Force (ADF), foreign defence agencies and commercial organizations. Activities typically take advantage of the unique attributes of the WTF, and often enable the conduct of programs that cannot be safely accomplished elsewhere in the world. Examples of past and current activities are provided under [Annex C](#), and include aircraft, weapon and explosive trials, space launch and re-entry programs and the testing of advanced airplane and spaceplane concepts.

2.2 DESCRIPTION

The WTF is the largest land-based range in the world and encloses a region of 127,000 square kilometres in northwest South Australia. A map showing the ~600 x 220 km extent of the WTF is provided in [Figure 2.2-1](#). Most of the land is owned by the South Australian government and by Aboriginal communities except for small areas belonging to the Commonwealth government. The terrain is generally flat, and is characterised by a mixture of stone-covered 'gibber' plains, large sandy areas and normally dry salt-lakes. Vegetation typically comprises low saltbush and other desert shrubs, with areas of trees reaching a height of around 5 metres. Detailed terrain-related information is contained in the Kungahook and Marla-Oodnadatta Soil Conservation District Plans ([RD4](#) and [RD5](#)).

Woomera Village is located in the south-east corner of the WTF, and lies 500 km by road from Adelaide and 7 km from a railway siding at Pimba on the Stuart Highway. The mining communities of Roxby Downs and Olympic Dam are located 81 km and 90 km respectively to the north of Woomera.

Significant elements of the WTF include:

- Woomera Rangehead ('Range E') and associated facilities (eg Range Control Centre) and instrumentation sites (optical and radar);
- Woomera Restricted Airspaces ([RD6](#)) overlying the WTF (refer to [Figure 2.2-2](#));
- Lake Hart Air Weapons Range, Lake Hart Demolition Area and Large Scale Explosives Test Area; and
- Woomera Village, Woomera Airfield and the adjacent Technical Area.

The above elements are depicted in [Figure 2.2-3](#) and [Figure 2.2-4](#) and are described in [section 4](#).

A number of pastoral homesteads are located in the WTF to the east of longitude 133 degrees. Arrangements are made to evacuate pastoralists and other personnel when necessary for the safe conduct of trial activities. The locations of pastoral stations and homesteads are shown on the pastoral map of South Australia ([RD14](#)).

Two compact mining communities have been established in the WPA: Challenger Mine on the Commonwealth Hill pastoral station in the west, and Prominent Hill (village) on the Millers Creek pastoral station in the north.

The Stuart Highway passes through the WTF between Glendambo in the south and Coober Pedy in the north. Similarly, the Central Australia Railway runs through the WTF in a north-south direction from Tarcoola. The highway and railway link Adelaide with Darwin via Alice Springs.



Figure 2.2-1 : Map showing the location and extent of the Woomera Prohibited Area in north-west South Australia (SA).

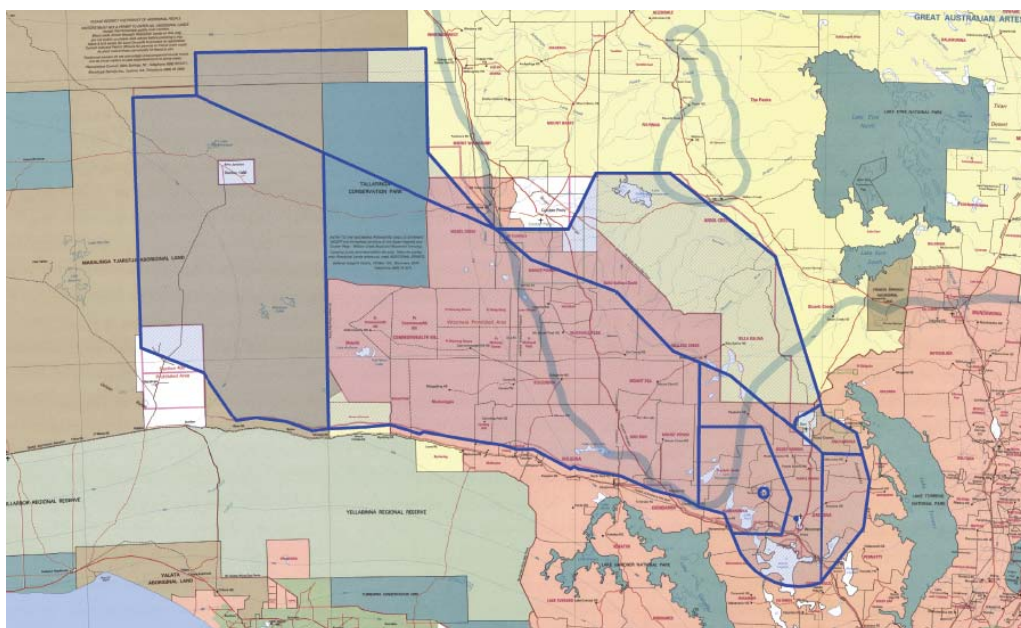


Figure 2.2-2 : Map showing the boundaries (blue) of the Restricted Airspace regions overlying the Woomera Prohibited Area.

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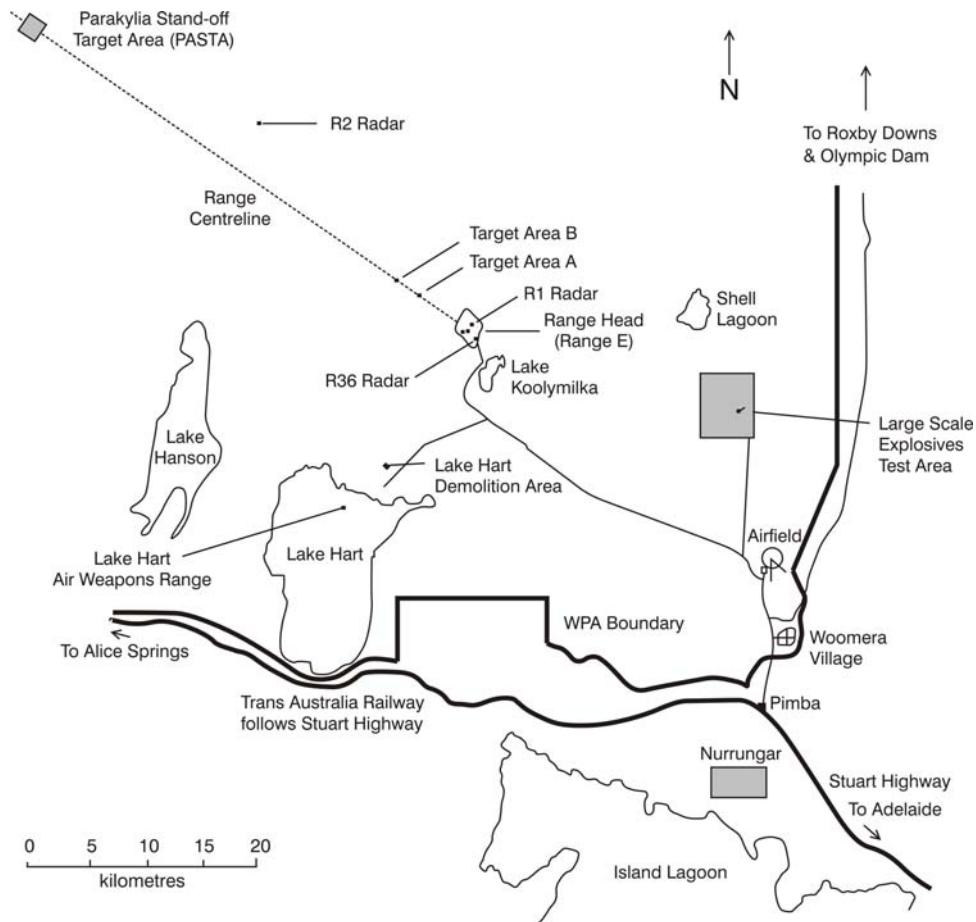


Figure 2.2-3 : Expanded view of the south-eastern WPA showing major elements including test areas and radar sites.

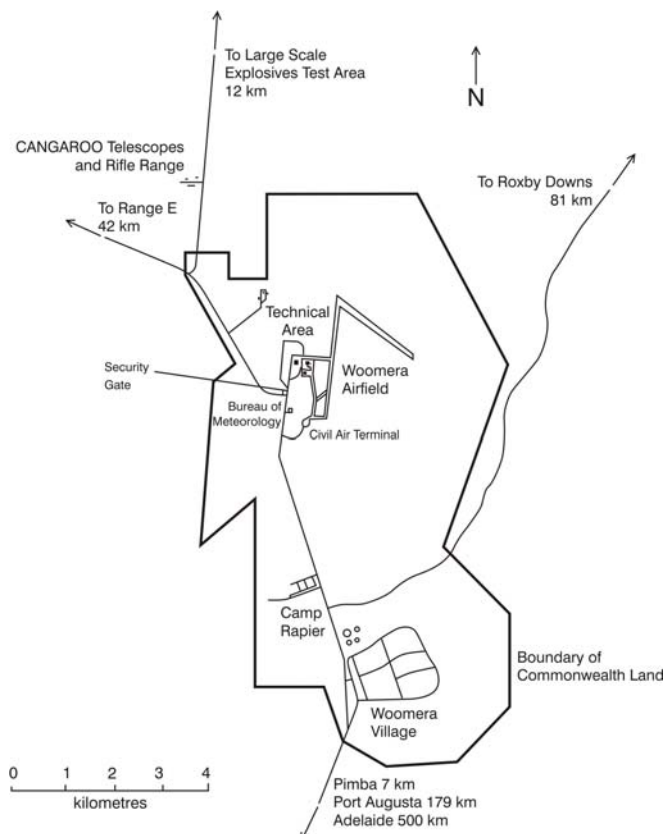


Figure 2.2-4 : Key elements near Woomera Village including Woomera Airfield, Technical Area and meteorological station.

2.3 ADMINISTRATION

The WTF/WPA is administered by the Department of Defence ('Defence') under Commonwealth legislation specially designating the area for the conduct of military test activities. The Commander of the RAAF Aerospace Operational Support Group (AOSG) is responsible for overall management of the WTF (including strategic planning and capability development), with responsibility for day-to-day operation and management vested in the Director WTF.

The provision of infrastructure support and basic services in the WTF, principally in Woomera Village and Woomera Airfield, is the responsibility of Defence Support - Woomera (DS-WRA). The Manager, DS-WRA is responsible for oversight of facilities and services. DS-WRA also provides guidance concerning environmental and indigenous heritage management within the WTF.

Trial activities undertaken at the WTF are subject to approval by Commander AOSG in accordance with *Policy and Procedures for the Use of the Woomera Prohibited Area and Woomera Test Facility* (RD3). This document identifies supported categories of activities, the information required from prospective users and the conditions that apply to the conduct of trial activities (including safety, liability, and environment and heritage requirements). The procedure for applying to use the WTF and gaining approval from AOSG is described in [section 7](#) below.

Certain trial activities may also require approval from other Commonwealth government regulatory organisations. Civil programs of an airborne nature that extend outside the WTF may require approval from the Civil Aviation Safety Authority (CASA) in accordance with requirements defined in Part 101 of Civil Aviation Safety Regulations 1998 (RD8). Additionally, applicable space activities³ require authorisation by the Space Licensing and Safety Office (SLASO) under the Space Activities Act 1998 (RD9) and associated Space Activities Regulations (RD10).

2.4 ATTRIBUTES

The WTF offers a number of compelling attributes from a user perspective including:

- Vast area with a very low population density⁴ which is ideal for the safe conduct of a wide variety of hazardous trial activities (unique for a land-based range);
- Permanently restricted airspace overlying the WTF which can be activated via NOTAM when required;
- Comprehensive instrumentation for supporting airborne trials and the launch of rockets, missiles and target drones;
- Air weapons ranges for the testing of inert and live ordnance (eg aircraft release, ground missile launch and artillery firings);
- A readily available and well maintained airfield capable of handling most types of military and civil aircraft (day and night);
- Large Scale Explosives Test Area for ground-based trials including protective shelters for personnel and equipment;
- Explosive Ordnance demolition and burning area for the destruction of military and commercial explosives;
- Certified magazines for the safe storage of Explosive Ordnance such as rocket motors, explosive charges and ammunition;
- Capability for implementing strict security arrangements for range safety management and for sensitive military or commercial programs;

³ The Space Activities Act 1998 applies to launch vehicles exceeding an altitude of 100 km, and to re-entry vehicles landing on Australian territory.

⁴ The average population density of the WTF, excluding Woomera Village and mining camps, is approximately one person per thousand square kilometres (principally pastoral families who are evacuated when necessary for trial safety).

- Flat terrain with sparse vegetation which facilitates the location and recovery of test vehicles, as well as the tracking of objects to low elevation angles;
- Benign electromagnetic environment for Electronic Warfare and other sensitive trials (also suitable for the conduct of GPS interference trials);
- Favourable desert climate with excellent atmospheric clarity enabling year-round operations (typical day temperatures range from 15-25° C in winter to 30-40° C in summer);
- Southern hemisphere location which permits the study of celestial objects or phenomena not visible from the northern hemisphere;
- Extensive support facilities at the Woomera Rangehead, Woomera Airfield, Technical Area and Woomera Village;
- Comprehensive technical and logistic services available from Defence, the Bureau of Meteorology and local companies; and
- Availability and flexibility together with a supportive approach to commercial applications encouraged by AOSG/Defence.

2.5 CAPABILITIES

The nine core capabilities of the WTF summarised below are available to Range users through arrangements with AOSG.

2.5.1 Coarse TSPI

Coarse TSPI (Time Space Position Information) is defined as the capability to track and record the position in three axes, against time, of an aerospace vehicle to an accuracy of 10 to 50 metres. Coarse TSPI is used for real time tracking of test articles for range safety and range control purposes. Three radar systems providing Coarse TSPI capability are available at the WTF; specifically two Adour radars (R1 and R2) and an MPS-36 radar (R36).

2.5.2 Precision TSPI

Precision TSPI is defined as the capability to determine the position in three axes, against time, of an aerospace vehicle to an accuracy of better than 5 metres. Precision TSPI is used for positional analysis of the system under test where a higher accuracy than Coarse TSPI is required, and is usually derived by post-processing of recorded data to reduce errors and correlate independent tracking sources. Kinetheodolites are currently used at the WTF to provide a Precision TSPI capability.

2.5.3 Behavioural Information

Behavioural Information refers to data collected by instruments such as high speed cameras that provide test article trajectory data, including weapon impact scoring with a sample rate of 50 to 100 points per second, a positional accuracy of ± 0.1 m and a velocity accuracy of ± 2 m/s. AOSG operates several film and video camera systems with kinematic mounts able to meet a range of behavioural performance requirements.

2.5.4 Launch Services

Launch Services refers to the ability to manage and control the launch of rockets, missiles, targets and Unmanned Aerial Vehicles (UAVs) in accordance with prescribed requirements and procedures. This capability, exercised from the Range Control Centre, is supplemented by Coarse TSPI, Behavioural Information, Range Control & Safety, and Range Management capabilities for operational activities.

2.5.5 Range Control and Safety

Range Control and Safety is coordinated from the Range Control Centre, and is the ability to control and monitor all aspects of the test program including launch, flight termination, safety template management, communication, receipt and processing of telemetry flight data, provision of direction and feedback to aircraft (eg for weapon release), and airspace and ground-space management.

2.5.6 Airfield Base Services

Airfield Base Services encompasses the provision of hangars at different locations within the WTF (Woomera Airfield and Evetts Field near the Woomera Rangehead), maintenance of isolated technical areas, office accommodation, refuelling service, Air Traffic Control and runway services, as well as utilities, telecommunications and security for the purpose of conducting aircraft-related trials at the WTF.

2.5.7 Ground Targets

Ground Targets refers to mobile and stationary targets used to verify weapon accuracy and potency, coupled with the ability to conduct impact scoring, collection of data from targets and capture of terminal phase data for the system under test.

2.5.8 Experimentation and Specialist Services

Experimentation and Specialist Services refers to the ability to support organisations such as the Defence Science and Technology Organisation (DSTO) for evaluating high speed weapons, conducting weapons breakdown and testing, performing directed energy trials and conducting vulnerability trials.

2.5.9 Range Management

Range Management is the ability to provide range planning, training, clearance and reporting, as well as the provision of expert advice on Range-related matters. Range Management can be provided on-site at Woomera or conducted remotely from AOSG Headquarters at RAAF Edinburgh (near Adelaide).

2.6 APPLICATIONS

The WTF is able to support an extremely diverse range of Test and Evaluation (T&E) and other applications of a Defence and non-Defence nature. Many of the application areas listed below are represented by recent and current activities featured in [Annex C](#).

2.6.1 Aircraft Systems – Non Weapon

Testing of aircraft systems not involving the release of weapons includes:

- Aircraft flight dynamics;
- Avionics and sensor system trials;
- Electronic Warfare and Navigation Warfare trials;
- Self-protection system trials (eg MAWS, RWR, chaff and flare);
- Signature measurement (eg infra-red, radar);
- Advanced subsonic, supersonic and hypersonic aircraft trials;
- Unmanned Aerial Vehicle (UAV) trials; and
- Aircraft trials under Hot / Dry⁵ conditions.

The above activities are best undertaken in the south-east region of the WTF due to the concentration of instrumentation, but can extend to the broader WTF as required. Aircraft operations can be conducted from Woomera Airfield, or alternately, sorties can be initiated from RAAF Edinburgh or elsewhere depending on aircraft range. Operations from Maralinga Airfield are also possible for programs in the western WTF (refer to [section 5.5](#)).

⁵ The location of the WTF is within the latitude range specified for military testing under 'Hot/Dry' conditions.

2.6.2 Aircraft Systems – Weapon Release

Testing of aircraft/helicopter systems involving weapon release, including Stores Management Systems and Stores Clearance trials, covers:

- Bombs (conventional and laser or GPS guided);
- Air-to-Air missiles (eg ASRAAM and AMRAAM);
- Air-to-Ground missiles;
- Air-to-Air and Air-to-Ground gunnery;
- Stand-off weapons (eg AGM 142, BVRAAM and JASSM); and
- Unmanned Combat Aerial Vehicle (UCAV) trials.

The primary area for the conduct of live (ie High Explosive) weapon trials is the Air Weapons Range on the northernmost part of Lake Hart, a normally dry salt-lake. Inert weapon impact is undertaken at Target Areas A and B and at the Parakylia Stand-off Target Area (PASTA).

2.6.3 Flight and Combat Training

Potential activities involving civilian and military flight training include:

- Basic and advanced pilot training;
- Remote area navigation training; and
- Combat training.

The WTF offers specific advantages for flight and combat training including the under-utilised airfield, extensive airspace, access to weapons ranges, secure environment, available support infrastructure and favourable year-round climate.

2.6.4 Drop Testing

Drop testing from aircraft or balloons encompasses:

- Testing of equipment and ordnance;
- Parachute trials and training (personnel and equipment including high altitude drops); and
- Parafoil testing (precision guidance and landing of equipment / vehicles).

The above trials can be undertaken in the vicinity of Woomera Airfield, near the Woomera Rangehead or elsewhere within the WTF.

2.6.5 Ground Trials and Exercises

Ground trials and exercises are potentially very diverse and include:

- Ground-to-Air missiles (eg RBS-70);
- Ground-to-Ground missiles (eg TRIGAT);
- Novel weapon systems (eg electronic / optical);
- Large scale explosive testing;
- Ordnance and propellant testing;
- Signature measurement (eg infra-red);

- Hot/Dry trials and training;
- Artillery and infantry exercises;
- Equipment and vehicle testing (military and civil); and
- Special Operations including Top Secret.

Ground trials and military exercises can be conducted in a wide range of locations in the WTF, including the Air Weapons Range at Lake Hart, the Large Scale Explosives Test Area and at rocket/missile launch areas such as LA9. Vegetation and terrain conditions offer diverse environments for ground exercises including open treeless plains, areas of trees and obscuring vegetation, sand dune regions and water-related features such as creek-beds, claypans and salt-lakes (normally dry). Environmental assessment is a particular consideration for the selection of suitable areas for ground activities.

2.6.6 Space Programs

Space-related programs that can be undertaken at the WTF encompass:

- Sounding rocket trials;
- Satellite launch programs;
- Re-entry vehicle landing and recovery;
- Space vehicle testing (eg scale-model spaceplanes); and
- Space propulsion system trials (eg hypersonic scramjet engines).

Sounding rocket launches are conducted at the Woomera Rangehead, taking advantage of a large ex-JAXA remotely controlled launcher with a usable rail length of ~20m. Space launch activities above 100km and re-entry activities are subject to licensing under the Space Activities Act 1998 ([RD9](#)).

2.6.7 Miscellaneous Activities

Miscellaneous activities that can be supported at the WTF include:

- Ordnance Storage with access to major road / rail links and test areas;
- Space Tracking, Telecommunications and Command;
- Astronomical Observations (noting existing Cangaroo telescopes); and
- Movie production outdoors (desert / salt-lake scenery) and indoors (aircraft hangars).

3 RANGEHEAD AND INSTRUMENTATION

3.1 RANGEHEAD

The Rangehead is located at the south-east corner of the WTF at 'Range E' and comprises the following facilities:

- Instrumentation Building (IB) housing the Range Control Centre and Tracking Data Centre for managing trial activities and range safety, and also accommodating the Timing and Communications Centre. The IB has provision for roof-mounted antenna equipment (eg telemetry and microwave antennae and satellite dishes) and offers comprehensive office space, meeting rooms and amenities;
- Facilities for the assembly and checkout of flight vehicles and payloads (Test Shops 1 and 4), and for the preparation and storage of rocket motors and explosive ordnance (Explosives Fitting Shop and Round Ready Store);
- Launch Areas (see [section 4.2](#)) for sounding rocket and missile launches (pads, blockhouses, anemometer tower, firing circuits, data cabling, etc);
- Prepared and surveyed sites for existing and deployable instrumentation;
- Meteorological shed for the release of weather balloons with accompanying theodolite enclosure and instrument preparation room;
- Trials' team facility (Building 517) comprising office areas, user amenities and roof attachment points for instrumentation; and
- Helicopter landing pad.

Evetts Field located at the Rangehead has two partially sealed runways which are currently unserviceable for aircraft operations but can support small UAV trials. Hangar 5 at Evetts Field is available for supporting trial programs and has an internal span of 45 m and a central floor area of 2900 square metres.

Communication services at the Rangehead are comprehensive and include optical fibre links to instrumentation and target sites (eg PASTA) and to Woomera Village, a multi-channel intercom system, UHF and VHF radio networks, microwave links for video, voice and data, and digital GSM telephone coverage. A high power single sideband Defence-operated HF radio system covers the entire WTF and beyond. Access to broadband ADSL internet connection can be negotiated with AOSG.

3.2 INSTRUMENTATION

Existing instrumentation operated by AOSG includes:

- Adour C-band Radars (R1 and R2) located 26 km apart for real-time Coarse TSPI. The radars are capable of tracking a one square metre target to a distance of ~200 km with a spherical error of 40 m;
- MPS-36 C-band Radar (R36) located at the Woomera Rangehead and offering four times the radiated power of the Adour radars and greater operational flexibility for Coarse TSPI purposes;
- Contraves Kinetheodolites for Precision TSPI using cine film for post-trial processing. The kinetheodolites are linked to the radars for target acquisition and are capable of providing a spherical error of a few metres within an area of 400 square kilometres;
- Behavioural Cameras for high speed recording of targets using photographic and video systems either manually or remotely started (radar-slaved 'Rakimo' Rate Assisted Kinematic Mounts are also available);
- Deployable Vista System 550 L-band telemetry and data processing systems incorporating IRIG standards for real-time monitoring and data recording at acquisition rates of up to 20 Mbps;
- Precision Timing System based on a GPS Time Transfer Receiver and providing range timing signals to IRIG and NASA standards (an associated Instrumentation Programming Unit enables automatic sequencing including rocket motor ignition); and

- Mobile Vaisala GPS autosonde facility for measuring upper atmosphere meteorological conditions as a function of altitude including wind speed and direction.

The Tracking Data Centre (TDC) within the Range Control Centre processes real-time data from the R1, R2 and R36 radars and displays vehicle position on video display screens and large format plotting tables. Displayed data is used for range safety control with respect to defined safety templates and also for directing aircraft; eg to ordnance release points. Range users can receive real-time tracking data from the TDC, or conversely, supply data to the TDC to assist target acquisition (eg telemetered inertial or GPS positions).

In addition to existing instrumentation, Range users often deploy their own equipment at the WTF, assisted by Defence and commercial organisations (eg telemetry and flight termination systems).

4 TEST AREAS

The following sections summarise test areas available for the conduct of Defence and Commercial trials. Locations of the sites are depicted in [Figure 2.2-3](#). All ranges and test areas lie under Woomera Restricted Airspaces which are activated by NOTAM when required. The airspace regions encompass the Woomera Control Zone, R237, R240, R250A, R250B, R250C, R260, R275, R276, R283, R284A and R284B, and are defined in the Designated Airspace Handbook ([RD6](#)) and depicted in [Figure 2.2-2](#).

4.1 TARGET AREAS

Several target areas are available within the WTF for inert and live ordnance impact as follows:

- Lake Hart Air Weapons Range in the northernmost part of Lake Hart, a normally dry salt-lake. The range measures approximately 10x15 km and is used for the release of live ordnance. Ground-launched missile and artillery firings are also undertaken at Lake Hart;
- Parakylia Stand-Off Target Area (PASTA) located 46 km downrange from the Woomera Rangehead and approved for the firing of inert / practice ordnance (and with a high bandwidth fibre optic link to the Instrumentation Building for real-time video and data); and
- Target Areas A and B on the Range centreline for the release of inert ordnance.

4.2 LAUNCH AREAS

Three operational Launch Areas are located at the Woomera Rangehead, and are referred to as LA1, LA2 and LA9.

LA1 and LA2 are located side-by-side, approximately one kilometre downrange from the Instrumentation Building. They share a concrete apron as well as power and signal distribution services. LA1 is equipped with a large air-conditioned movable shelter enclosing a heavy-duty ex-JAXA remotely controlled launcher. LA2 is fitted with two smaller launchers (only the HAD launcher is currently operational) and is equipped with an underground blockhouse.

LA9 is located 6.4 km downrange from the Instrumentation Building and is used for the launch of small sounding rockets and for ground-to-ground missile firings. Other launch activities can be conducted from LA9 subject to safety assessment.

4.3 EXPLOSIVE AREAS

Two explosive areas are available for ground-based trials and Explosive Ordnance (EO) disposal activities:

- Large Scale Explosives Test Area (LSETA) equipped with protective Spantech shelters for personnel and equipment. LSETA is especially suited to Explosive Store-House trials involving the testing of structures designed to internally contain and externally withstand massive detonations. Trials of up to 75 tonnes Net Explosive Quantity (NEQ) have been conducted at LSETA; and
- Lake Hart Demolition Area (LHDA) which is used for the testing and explosive destruction of military and commercial explosives (up to 17 tonnes NEQ per blast).

5 SUPPORT INFRASTRUCTURE

The following sections provide an overview of the infrastructure and services available to support trial activities at the WTF.

5.1 WOOMERA VILLAGE

Facilities and services in Woomera Village are comprehensive and include the commercially-operated ELDO Hotel, accommodation blocks, self-catering apartments, residential houses, village store, community hospital, police station, post office, heritage and visitors centre, marine centre, school, library, astronomical observatory and recreational facilities (refer to www.woomera.com.au/village.htm). Woomera Emergency Services provides a highly responsive capability covering Ambulance, Fire and Rescue. Medical support is also available through the Royal Flying Doctor Service. Communications services include a fibre optic link to the public telephone and high-speed data networks, digital cellular telephone systems, and locally broadcast television and radio stations. Connection to ADSL broadband internet can be arranged.

Additional accommodation of a basic nature suitable for military personnel is available at Camp Rapier adjacent to Woomera Village ([Figure 2.2.4](#)). Interest in using Camp Rapier should be directed to the Manager, DS-WRA (refer to contact details under [Annex B](#)).

5.2 WOOMERA AIRFIELD

Woomera Airfield is located approximately 6 km to the north of Woomera Village (refer to [Figure 2.2-4](#)) and comprises the following elements:

- Sealed north-south (18/36) runway of dimensions 2372 x 45 metres capable of handling aircraft ranging from F-111 and F-18/A to C-5A, B-747 and AN-124 (small and large UAV trials are also undertaken using the main runway);
- Unsealed southeast-northwest (12/30) runway of dimensions 1650 x 30 metres used for emergency and back-up purposes;
- Non-Directional Beacon (NDB) navigation aid;
- Three 3,000 square metre hangars, two of which (Hangars 1 and 2) are available for supporting trial programs (Hangar 3 is allocated to ARDU);
- Night Vision Goggles testing capability within Hangar 3 (dark environment with artificial moon);
- Breathing Air Facility adjacent to Hangar 3 for producing liquid oxygen (jet aircrew use);
- Ordnance loading areas for supporting live firing trials;
- Civil Air Terminal and storage buildings; and
- Control tower with crew room.

The main runway is equipped with lighting and has an arrester hook capability at both ends for simulating aircraft carrier landings and for fast jet landing safety (fixed pads for installing BAK12 rotary hydraulic arrester gear). Details concerning airfield frequencies, navigation aids, lighting, movement areas and special requirements are contained in the En Route Supplement Australia ([RD7](#)).

The airfield is secured against unauthorised entry, and is used by the RAAF in support of trials at the WTF, and also by the Royal Flying Doctor Service and private operators. Non-aircraft related activities are also conducted at Woomera Airfield such as high-speed vehicle testing along the main runway and use of hangar and workshop facilities for vehicle preparation and other activities. Current utilisation of the airfield is low.

5.3 TECHNICAL AREA

The Technical Area is adjacent to Woomera Airfield and offers the following facilities:

- Aviation fuel supplies with a capacity of 160,000 litres;
- Secure magazine for storing explosive ordnance;
- Secure storage area for trial materials;
- Mechanical workshop (light engineering); and
- Vehicle maintenance workshop.

5.4 NURRUNGAR

The ex-JDFN site at Nurrungar on Commonwealth land approximately 20 km south of Woomera Village (refer to [Figure 2.2-3](#)) retains decommissioned facilities that may be suitable for certain programs. The facilities and external dimensions include:

- Technical Building measuring 66.5 x 51.3 metres;
- Administration Building measuring 24.6 x 24.9 metres;
- Warehouse / Amenities area measuring 37.0 x 29.6 metres;
- Large radome structure; and
- Perimeter security fence.

Interest in using the Nurrungar site should be directed to the Manager, DS-WRA in the first instance (refer to contact details under [Annex B](#)).

5.5 MARALINGA

Maralinga is located adjacent to the far west of the WTF at a distance of ~520 km from Woomera Village. The area, known as Section 400, is separate from the WTF and is administered by the Department of Education, Science and Training (DEST). Subject to approval by DEST, facilities at Maralinga may be available to support trial activities in the western WTF. The facilities comprise:

- Maralinga Airfield with a sealed north-south runway measuring 2500 x 45 metres and an extensive tarmac area; and
- Maralinga Village with air-conditioned accommodation blocks, other buildings and amenities, and satellite telephone and television.

Potential applications of Maralinga include the deployment of aircraft, crew and logistic support equipment for conducting aircraft/missile and other trials in the western WTF, taking advantage of the remote and secure area and ability to accommodate large safety templates in this region.

6 SUPPORT ORGANISATIONS

The organisations summarised below provide a comprehensive range of services in support of trial programs (subject to financial and other arrangements). Contact details for individual organisations are provided under [Annex B](#).

6.1 AEROSPACE OPERATIONAL SUPPORT GROUP

AOSG is the policy, approval, management and safety authority for activities conducted at the WTF and is headquartered at RAAF Edinburgh near Adelaide. While focussed on the Test and Evaluation (T&E) requirements of the Australian Defence Force, AOSG can provide support for external customers via arrangement with the Director WTF. AOSG has a broad range of specialist T&E expertise and maintains a comprehensive suite of fixed and transportable trial instrumentation capable of meeting international standards. Instrumentation includes radars, kinetheodolites, high-speed behavioural cameras, telemetry systems, meteorological sensors and ordnance firing equipment. Potential AOSG services correspond to the nine core capability sectors summarised under [section 2.5](#).

AOSG personnel deploy to Woomera from RAAF Edinburgh as required to support trial activities, typically on a campaign basis. A small Ranges Group belonging to AOSG is based at Woomera, and comprises a Range Activities Manager, Range Safety Manager and Area Control Officer. Staff from the Ranges Group are available to support WTF users, including assistance with pre-trial familiarisation visits.

6.2 DEFENCE SUPPORT - WOOMERA

DS-WRA is located at the Defence Centre Woomera and is responsible for managing Woomera Village. This role includes maintaining facilities, authorising access, managing residential accommodation and providing municipal services. DS-WRA offers services to WTF users such as guidance on environmental and heritage issues, liaison with indigenous communities, and facilitation of environmental clearances for trial activities.

DS-WRA is supported on-site by BAE Systems under a ten-year Woomera Commercial Support Contract which entails the provision of a wide range of services such as facilities and equipment maintenance, security, transport, communications, emergency services, information technology, aircraft re-fuelling and general administration support. The contract also includes support to Defence in developing new Woomera business and assistance to organisations in applying to use the WTF.

6.3 DIRECTORATE OF TRIALS

The Directorate of Trials (DTRIALS) undertakes regular test activities at the WTF such as Explosive Store-House trials at LSETA and hypersonic rocket flights. DTRIALS can provide support to foreign defence agencies and potentially other WTF clients in areas such as trial coordination and provision of specialist personnel and equipment. Support to Range users requires negotiation with the Director of DTRIALS.

6.4 BUREAU OF METEOROLOGY

The Bureau of Meteorology (BOM) station adjacent to Woomera Airfield ([Figure 2.2-4](#)) is a key element of the Bureau's nationwide network. The facilities and services comprise:

- Modern building housing staff and equipment;
- WF100 Weather Watch C-band radar with a range of approximately 500 km;
- Vaisala Autosonde facility for the automatic release of GPS sondes to measure upper atmospheric meteorological conditions versus altitude (usually to 25-30 km);
- Automatic Weather Station which continuously records surface weather conditions; and
- Transmission of half-hourly aerodrome weather reports (METAR) to ICAO standards.

The autosonde facility launches one balloon per day at 0845 Central Standard Time. Additional sonde flights can be negotiated with the BOM but need to take place about 3 hours after regularly scheduled sondes. The autosonde system provides pressure, temperature, humidity and wind speed and direction in a standard format that can be supplied electronically to Range users.

Additionally, the BOM has acquired an [Upper-Air Wind Profiler](#) at Woomera installed originally for JAXA. The 100 kW Doppler-based radar is located ~26 km downrange from the Instrumentation Building and is capable of generating vertical profiles of horizontal wind speed and direction at altitudes up to ~20 km. Data can be made available to Range users in support of airborne trial activities via arrangement with the BOM.

Custom meteorological services can also be provided by the BOM via negotiation with the Bureau's Special Services Unit. Charges are dependent on the extent of additional labour and consumables beyond those required for normal operations. Special services can include tailored forecasts for the Woomera area, computer modelling, data delivery and provision of design systems.

BOM staff may also be contracted to operate a balloon release facility at the Woomera Rangehead to measure wind conditions close to the rocket launch area (eg for launcher aiming).

6.5 LOCAL COMPANIES

Numerous trial support services are available from local companies in the Woomera area, including security, surveying, construction, electrical, communications, transport, aircraft refuelling, vehicle/plant hire, equipment repair and maintenance, emergency services, catering and cleaning, and administrative and information services. Additionally, aerospace companies based in Adelaide offer a range of specialised engineering, technical, management and logistic support services, and deploy to Woomera as required.

6.6 SOUTH AUSTRALIAN GOVERNMENT

The South Australian government encourages and facilitates Range-related business through the Defence SA unit located in Adelaide. Potential services include assistance in gaining access to other State agencies, guidance concerning local industry capability and advice concerning potential Commonwealth assistance to WTF clients. Support measures for WTF ventures may be available where economic benefits flow to the State and region.

7 UTILISATION OF THE WTF

7.1 GENERAL

Utilisation of the WTF is governed by *Policy and Procedures for the Use of the Woomera Prohibited Area and Woomera Test Facility* promulgated by Defence ([RD3](#)). Requests to use the WTF should be submitted to the Director WTF in accordance with the requirements listed under Annex A of [RD3](#). Specific topics include:

- Trial nature, schedule and support requirements;
- Trial organisations and principal personnel involved;
- Safety considerations (see [section 7.2](#));
- Environment and Heritage considerations (see [section 7.3](#));
- Indemnity / Insurance considerations (see [section 7.4](#)); and
- Proposed financial arrangements.

Prior to the submission of a formal application, it is recommended that prospective users seek guidance from AOSG and preferably visit Woomera for on-site discussions and inspection of relevant sites/facilities. Guidance can also be provided concerning available support and WTF usage fees that will apply.

The form of Defence approval to use the WTF varies depending on the nature and scale of the activity, and the organisations involved. For example, a large program involving a foreign defence agency or other overseas government entity may be approved under an inter-governmental Memorandum of Understanding (MOU). Other programs can be undertaken via commercial contracts.

Depending on the nature of the activity, prospective users of the WTF may also need to consult with other government organisations including:

- CASA for civil airborne trials extending outside the WTF and subject to Part 101 of Civil Aviation Safety Regulations 1998 ([RD8](#));
- SLASO for 'Category 5' space-related activities requiring authorisation under the Space Activities Act 1998 ([RD9](#));
- Australian Communications and Media Authority (ACMA) for approval to transmit on non-military frequencies; and
- Directorate of Spectrum and Communications Regulation (DSCR) for approval to transmit on military frequencies.

Consultation with other government organisations may also be required depending on the nature of the activity; eg approval to import, transport and store explosive items and other hazardous goods from Commonwealth or State authorities (eg see [RD13](#)).

7.2 SAFETY CONSIDERATIONS

A primary element of the AOSG approval process is demonstration that the proposed activity can be undertaken safely with negligible risk to personnel and minimal risk to property and the environment. The steps involved (except for SLASO-controlled activities; see below) are typically as follows:

- Conduct of a Risk Analysis by the proponent in accordance with AOSG requirements applicable to the proposed activity;
- Independent assessment of the Risk Analysis by AOSG or a third party acceptable to AOSG including compilation of a report / recommendations; and
- Preparation of a Safety and Operations Plan by the user, taking into account considerations resulting from the Risk Analysis / Assessment.

AOSG normally appoints a Safety and Operations Liaison Officer (SOLO) to provide support to Range users and to monitor adherence to an agreed Safety and Operations Plan.

A different process applies to 'Category 5' activities subject to the Space Activities Act for which SLASO is the safety authority. Range users are required to submit a Risk Hazard Analysis to SLASO in compliance with the Flight Safety Code ([RD11](#)). SLASO is also responsible for appointing a safety officer to monitor the launch or re-entry activity. Advice should be sought as early as possible from SLASO concerning specific requirements including Environment and Heritage considerations that apply to Category 5 activities (refer to contact details in [Annex B](#)).

7.3 ENVIRONMENT AND HERITAGE CONSIDERATIONS

Defence also requires an assessment of the potential Environment and Heritage impact of proposed trial activities in the WTF. Guidance concerning the requirements can be provided by Director WTF who will coordinate approval of an Environmental Clearance Certificate (containing conditions of approval) by the Regional Environmental Officer based on information supplied by the test agency. For atypical or major programs, advice may need to be sought from Environment Australia to determine whether proposed activities are deemed significant under the [Environment Protection and Biodiversity Conservation Act 1999](#).

7.4 INDEMNITY / INSURANCE CONSIDERATIONS

Defence requires that acceptable indemnity / insurance provisions are made by Range users, commensurate with possible worst-case trial outcomes in respect to Third Party injury to personnel and damage to property. A minimum of A\$20M is required by Defence for public liability insurance.

In the case of Category 5 activities subject to the Space Activities Act 1998, users are required to undertake a Maximum Probable Loss analysis in accordance with the methodology defined in [RD12](#). Guidance should be sought from SLASO concerning this requirement.

8 SUMMARY COMMENTS

In summary, the WTF is a unique global asset, offering the capability to safely conduct hazardous trials and other activities that cannot be readily undertaken elsewhere in the world, especially where a land-based range is essential (eg for vehicle recovery). AOSG, supported by BAE Systems and the South Australian government, encourages the commercial use of the WTF where programs are compatible with Defence activities. Prospective users are invited to contact the Director WTF in the first instance to discuss requirements and to receive advice prior to submitting a formal application. Visits to Woomera are also encouraged to evaluate test sites and facilities first-hand, and to discuss support requirements with AOSG and local organisations.

ANNEX A : ABBREVIATIONS AND REFERENCE DOCUMENTS

A1 ABBREVIATIONS

ABBREVIATION	DESCRIPTION
ACMA	Australian Communications and Media Authority
ADF	Australian Defence Force
ADSL	Asynchronous Digital Subscriber Line
ALARM	Air Launched Anti-Radiation Missile
AMRAAM	Advanced Medium Range Air-to-Air Missile
AOSG	Aerospace Operational Support Group
ARDU	Aircraft Research and Development Unit
ASRAAM	Advanced Short Range Air-to-Air Missile
BOM	Bureau of Meteorology
BVRAAM	Beyond Visual Range Air-to-Air Missile
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulations
DEST	Department of Education, Science and Training
DI	Defence Instruction
DITR	Department of Industry, Tourism and Resources
DOD	Department of Defence
DSCR	Directorate of Spectrum and Communications Regulation
DSG	Defence Support Group
DSTO	Defence Science and Technology Organisation
DTRIALS	Directorate of Trials
ELDO	European Launcher Development Organisation
EO	Explosive Ordnance
GPS	Global Positioning System
GSM	Global System for Mobiles
HAD	High Altitude Diagnostic
HF	High Frequency
IB	Instrumentation Building
ICAO	International Civil Aviation Organisation
IRIG	Inter-Range Instrumentation Group
JASSM	Joint Air-to-Surface Standoff Missile
JAXA	Japan Aerospace Exploration Agency
JDAM	Joint Direct Attack Munition
JDFN	Joint Defence Facility Nurrungar
LA	Launch Area

ABBREVIATIONS AND REFERENCE DOCUMENTS

ABBREVIATION	DESCRIPTION
LHAWR	Lake Hart Air Weapons Range
LHDA	Lake Hart Demolition Area
LSETA	Large Scale Explosives Test Area
MAWS	Missile Airborne Warning System
METAR	Meteorological Aerodrome Report
NASA	National Aeronautics and Space Administration
NDB	Non-Directional Beacon
NEQ	Net Explosive Quantity
NOTAM	Notice to Airmen
PASTA	Parakylia Standoff Target Area
RAAF	Royal Australian Air Force
RAF	Royal Air Force
RAKIMO	Rate-Assisted Kinematic Mount
RAN	Royal Australian Navy
RCC	Range Control Centre
RD	Reference Document
RF	Radio Frequency
RWR	Radar Warning Receiver
SA	South Australia
SLASO	Space Licensing and Safety Office
SOLO	Safety and Operations Liaison Officer
TDC	Tracking Data Centre
T&E	Test and Evaluation
TS	Test Shop
TSPI	Time Space Position Information
UAV	Unmanned Aerial Vehicle
UCAV	Unmanned Combat Aerial Vehicle
UHF	Ultra High Frequency
VHF	Very High Frequency
WPA	Woomera Prohibited Area
WTF	Woomera Test Facility

A2 REFERENCE DOCUMENTS

RD1	Title:	<i>Fire Across the Desert : Woomera and the Anglo-Australian Joint Project 1946-1980</i>
	Document No:	ISBN 0 644 06068 9
	Date of Issue:	September 1989
	Publisher:	Australian Government Publishing Service
RD2	Title:	<i>Woomera : The First Fifty Years</i>
	Document No:	-
	Date of Issue:	1997
RD3	Publisher:	Woomera Board
	Title:	<u>Policy and Procedures for the Use of the Woomera Prohibited Area and Woomera Test Facility</u>
	Document No:	DI(G) ADMIN 38-1
	Date of Issue:	4 June 2007
RD4	Publisher:	Department of Defence
	Title:	<u>Kingoonya Soil Conservation District Plan</u>
	Document No:	ISBN 0 7308 4353 X / AGDEX 577
	Date of Issue:	August 1996
RD5	Publisher:	Kingoonya Soil Conservation Board
	Title:	<u>Marla-Oodnadatta Soil Conservation District Plan</u>
	Document No:	
	Date of Issue:	1997
RD6	Publisher:	Marla-Oodnadatta Soil Conservation Board
	Title:	<u>Designated Airspace Handbook (DAH)</u>
	Document No:	
	Date of Issue:	Latest issue
RD7	Publisher:	Airservices Australia
	Title:	<u>En Route Supplement Australia (ERSA)</u>
	Document No:	
	Date of Issue:	Latest issue
RD8	Publisher:	Airservices Australia
	Title:	<u>Unmanned Aircraft and Rocket Operations</u>
	Document No:	Part 101 of Civil Aviation Safety Regulations 1998
	Date of Issue:	Effective 1 July 2002
RD9	Publisher:	Civil Aviation Safety Authority
	Title:	<u>Space Activities Act 1998</u>
	Document No:	Act No. 123 of 1998
	Date of Issue:	3 December 2002 (or later issue)
	Publisher:	Commonwealth Government

RD10	Title:	<i>Space Activities Regulations 2001</i>
	Document No:	SR 2001 No. 186
	Date of Issue:	30 April 2004 (or later issue)
	Publisher:	Commonwealth Government
RD11	Title:	<i>Flight Safety Code</i>
	Document No:	ISR 2001/152
	Date of Issue:	1 July 2002 (second edition)
	Publisher:	Department of Industry, Tourism and Resources
RD12	Title:	<i>Maximum Probable Loss Methodology</i>
	Document No:	ISR 2001/150
	Date of Issue:	1 July 2002 (second edition)
	Publisher:	Department of Industry, Tourism and Resources
RD13	Title:	<i>Explosives Transport Regulations 2002</i>
	Document No:	SR 2002 No. 92
	Date of Issue:	2 May 2002
	Publisher:	Department of Regional Services, Territories and Local Government
RD14	Title:	<i>Pastoral Areas of South Australia</i> ⁶
	Document No:	-
	Date of Issue:	May 2007
	Publisher:	Department of Water, Land and Biodiversity Conservation

⁶ Map at 1:250,000 scale showing pastoral and WPA boundaries as well as other features in the WPA including the locations of pastoral homesteads and access tracks.

ANNEX B : CONTACT DETAILS

B1 CONTACT LIST

The following table lists contact details for personnel and organisations referenced in [section 6](#) and elsewhere in the text.

Position / Role	Address	Numbers / E-mail
Director Woomera Test Facility (policy, approval and aerospace safety authority for WTF activities)	Aerospace Operational Support Group RAAF Base Edinburgh SA 5111	Tel : +61 (0)8 8393 3671 Fax : +61 (0)8 8393 2498 E-mail : woomera.testfacility@defence.gov.au
Manager Base Services (management of facilities and services, and support to WTF users)	Defence Support - Woomera Dewrang Avenue Woomera SA 5720	Tel : +61 (0)8 8674 3211 Fax : +61 (0)8 8673 3308 E-mail : (call or fax first)
Business Manager Woomera (assistance to Defence in developing new WTF business)	BAE Systems 2-6 Ardtornish Street Holden Hill SA 5088	Tel : +61 (0)8 8266 8263 Fax : +61 (0)8 8266 8261 E-mail : woomera.business@baesystems.com.au
Director of Trials (trial-related support to WTF users)	Directorate of Trials Department of Defence Russell Offices, R1-6-A045 Canberra, ACT 2600	Tel : +61 (0)2 6265 7960 Fax : +61 (0)2 6265 7979 E-mail : (call or fax first)
General Manager, General Aviation Operations Branch (approval authority for CASA controlled civil air activities)	Civil Aviation Safety Authority CASA Building Corner Northbourne Avenue and Barry Drive, Canberra, ACT 2600	Tel : +61 (0)2 6217 1093 Fax : +61 (0)2 6217 1500 E-mail : (call or fax first)
Director, SLASO (approval authority for SLASO controlled space activities)	Space Licensing and Safety Office Department of Industry, Tourism & Resources Level 4, 33 Allara Street Canberra, ACT 2600	Tel : +61 (0)2 6213 6986 Fax : +61 (0)2 6213 7249 E-mail : director.slaso@industry.gov.au
Customer Services Group (approval to transmit on non-military frequencies)	Australian Communications and Media Authority Purple Building, Benjamin Offices Belconnen, ACT 2616	Tel : +61 (0)2 6219 5378 Fax : +61 (0)2 6219 5393 E-mail : aas@acma.gov.au
Radio Spectrum Planners (advice concerning transmission on military frequencies)	Directorate of Spectrum and Communications Regulation CP1-4-019, Campbell Park Offices Canberra, ACT 2600	Tel : +61 (0)2 6266 3618 Fax : +61 (0)2 6266 3646 E-mail : (call or fax first)
Supervising Meteorologist (meteorological support to WTF users)	Bureau of Meteorology 25 College Road Kent Town SA 5067	Tel : +61 (0)8 8366 2635 Fax : +61 (0)8 8366 2651 E-mail : (call or fax first)
Chief Executive (industry guidance and assistance in the development of new WTF business)	Defence SA Level 9, Terrace Towers 178 North Terrace Adelaide, SA 5000	Tel : +61 (0)8 8303 2400 Fax : +61 (0)8 8303 2410 E-mail : defence@state.gov.au

B2 WEBSITE LINKS

The following table provides links to websites of relevance to the conduct of trials and other programs at the Woomera Test Facility.

Website	Link	Comments
Woomera – General (Range, Village, Tourism, Community, Events, Maps and History)	www.woomera.com.au	Website developed and maintained by BAE Systems for the Department of Defence and Woomera community
Aerospace Operational Support Group	www.defence.gov.au/raaf/organisation/info-on/groups/aosg.htm	WTF policy, approval, safety and capability development authority, and support to Range users
Defence Support Group	www.defence.gov.au/dsg	Management of facilities and services, and support to Range users through DS-WRA
Directorate of Trials	www.defence.gov.au/capability/dtrials	Specialist trial support to Range users (upon negotiation)
Australian Communications and Media Authority	www.acma.gov.au	Approval to transmit on non-military frequencies including downloadable application forms
Civil Aviation Safety Authority	www.casa.gov.au	Safety authority for civil air activities subject to Part 101 of CASR 1998 [RD8]
Space Licensing and Safety Office	www.industry.gov.au/space	Safety authority for trial activities subject to Space Activities Act [RD9]
Bureau of Meteorology	www.bom.gov.au	Support to Range users including custom meteorological services
Defence SA SA Government	www.defence-sa.com	Guidance concerning industry capability and facilitation of WTF commercial ventures
SafeWork SA (Dangerous Substances Section)	www.safework.sa.gov.au	Advice and approval concerning use of explosives and other Dangerous Goods in South Australia



Australian Government

Department of Defence

TRIAL ACTIVITIES AT THE WOOMERA TEST FACILITY



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1 INTRODUCTION

This annex to the Woomera Test Facility (WTF) Capability Brief features a selection of trial activities conducted at the WTF, and is aimed at illustrating the diverse range of Defence and non-Defence programs that can be undertaken in this vast area. The material has been compiled by BAE Systems Australia in consultation with the RAAF Aerospace Operational Support Group (AOSG) and WTF users.

2 DEFENCE TRIALS

The following sections highlight trials undertaken at Woomera by the Department of Defence ('Defence') and overseas military agencies.

2.1 AMRAAM Missile Trials



Two successful firings of the AIM-120 Advanced Medium Range Air-to-Air Missile (AMRAAM) were conducted at the WTF in April/May 2001 by the RAAF Aircraft Research and Development Unit (ARDU) with support from 77 Squadron. AMRAAM is a software-controlled, radar-guided missile that gives pilots the ability to 'launch and leave' and to track multiple targets during a single engagement.

The firings from F/A-18 Hornets were part of the test and evaluation program leading to flight clearance by the Aircraft Stores Compatibility Engineering Agency and acceptance of AMRAAM into RAAF service. Both firings were successful,

with the missiles intercepting targets towed behind Kalkara drone aircraft. The 2001 trials followed initial AIM-7 Sparrow firings conducted at Woomera in Aug/Sep 2000 as part of Exercise Desert Cobra.

2.2 ASRAAM Missile Trials



ARDU conducted live firings of the AIM-132 Advanced Short Range Air to Air Missile (ASRAAM) at the WTF in May 2002. ASRAAM has been procured for the RAAF's F/A-18 Hornets, and to introduce the missile into service, a formal evaluation of the performance of the ASRAAM capability was undertaken at Woomera. The first test involved a flight safety assessment, performed by ARDU test pilots. The Hornet was flown to the limits of its performance with the ASRAAM on its wingtip station and the behaviour monitored. Live firings of the ASRAAM were performed subsequently using Kalkara drone aircraft as targets. The Hornets were based at Woomera Airfield and the Kalkara drones were launched from Evetts Field at the Woomera Rangehead.

2.3 ALARM Missile Trials



In August 2000, the Royal Air Force (RAF) conducted in-service firings of the Air Launched Anti-Radiation Missile (ALARM) from Tornado GR4 aircraft at Woomera (Exercise Dingo Dart). The ALARM missiles were directed towards a target at the Parakylia Stand-off Target Area (PASTA). AOSG provided operational support to the RAF including range control, C-band radar tracking and an F/A-18 photo-chase aircraft. Real-time cine and video coverage of the PASTA target site was also provided by AOSG. Exercise Dingo Dart was sponsored by the RAF's Air Warfare Centre.

2.4 AGM-142 Missile Trials



The United States Air Force (USAF) has conducted trials of the AGM-142 medium-range, electro-optically guided precision stand-off missile at the WTF using B-52 bomber aircraft (pictured with underslung missile). Inter-continental sorties initiated in the US were conducted in 1995 and 1997, with the rocket-powered missiles being launched towards a target site within the WTF. The WTF is well suited to stand-off weapon trials, given the large safety templates that can be accommodated, and the high security environment for classified weapons testing. Support for the AGM-142 trials was provided by ARDU.

2.5 Hellfire Missile Trials



Firings of laser-guided Hellfire missiles from the Australian Army's Tiger Armed Reconnaissance Helicopter (ARH) were conducted at the WTF in May 2005 and November-December 2005. A total of seven missiles were fired in the latter campaign, including three with live warheads. The firings were successful, with the missiles hitting targets at ranges between six and eight kilometres.

The purpose of the trials was to certify the Hellfire missile for operational use on the ARH.

2.6 Rapier Missile Trials



Numerous instrumented and operational trials of the Rapier ground-to-air missile have been conducted at the Lake Hart Air Weapons Range at the WTF. The Rapier is used in low level air defence (up to 10,000 feet) and was in service until 2005 with the 16th Air Defence Regiment of the Royal Australian Artillery. The Rapier system comprises a missile launcher unit and optical tracker. A radar in the launcher unit detects and identifies targets, and a transmitter on the launcher sends guidance commands to the missile in flight.

The Republic of Singapore Air Force ([165 Squadron](#)) has also conducted instrumented and operational test firings of Rapier and RBS-70 missiles at Lake Hart under Project Brightfire. The ground-to-air missile firings typically involve a target towed behind a Learjet.

2.7 TRIGAT Missile Trials



Testing of the TRIGAT Medium Range anti-armour missile was undertaken at Woomera between January and February 1998. The trials were sponsored by the UK Ministry of Defence, and were designed to test the performance of the missile under 'hot-dry' conditions. Numerous firings were conducted by an international team comprising British, German, Dutch, French and Belgian soldiers. The WTF was selected for the TRIGAT program in view of the optimum climatic conditions, purpose-built range facilities, available technical and infrastructure support, and safety and security considerations.

2.8 Kalkara Target Drone Trials



The Kalkara target drone system operated by the Royal Australian Navy (RAN) is deployed to Woomera when required in support of missile firings, notably trials of AMRAAM and ASRAAM from F/A-18 Hornet aircraft (see [section 2.1](#) and [section 2.2](#) above). The jet-propelled Kalkara drone is rocket boosted from a ground launcher and is capable of towing targets and carrying a variety of payloads (eg weapon sensor systems). Kalkara launches are undertaken from Evetts Field at the Woomera Rangehead. The drones are recovered by parachute at the end of their flights.

2.9 Nulka Hovering Rocket Decoy Trials



The Nulka hovering rocket is an Australian-developed, ship launched decoy used for protecting ships against missile attack. Powered by a solid fuel rocket motor, Nulka (Aboriginal word meaning 'to be quick') hovers away from its host ship, with its electronics package attracting the incoming missile by mimicking emissions from the target ship. Nulka is in service with the Royal Australian Navy, the US Navy and the Canadian navy.

Numerous Nulka trial campaigns have been conducted at the WTF since 1990, initially for developmental test and evaluation and subsequently for ongoing product enhancement, with the last trials in 1997-1999 involving a total of 15 firings. The WTF provided particular advantages for the trials, especially the high security and easy recovery of the classified Nulka decoys.

2.10 Hypersonic Rocket Trials



The successful initiation of HyShot sounding rocket flights by the University of Queensland (UQ) to test advanced scramjet propulsion (refer to [section 3.6](#)) has precipitated a series of Defence-sponsored hypersonic trials led by the Defence Science and Technology Organisation (DSTO) and involving UQ and other Australian and international partners. HyShot-3 and HyShot-4 carrying scramjet payloads were launched in March 2006, each involving Terrier-Orion rockets launched from the large ex-JAXA launcher installed for the NEXST program ([section 3.4](#)). More recently, a heavy-duty Talos-Castor vehicle carrying a scramjet payload developed by UQ and the US Defense Advanced Research Projects Agency (DARPA) and partners was launched on 15 June 2007 (pictured) under project HyCAUSE (Hypersonic Collaborative Australia / United States Experiment). The vehicle reached an apogee of ~500 km and impacted at a down-range distance of ~450 km after achieving Mach 10 at re-entry. Refer to UQ's [Centre for Hypersonics website](#) for images and video clips of the HyShot and HyCAUSE flights.

Ongoing hypersonic trials are planned at Woomera by DSTO and the US Air Force Research Laboratory under a ~6 year collaborative program known as HIFiRE (Hypersonic International Flight Research Experimentation). Up to ten HIFiRE sounding rocket flights are intended commencing in 2008, with the possibility of a follow-on program.

2.11 Extended Range JDAM Trials



An F/A-18 aircraft operated by ARDU provided support in 2004 for a concept technology demonstration program involving the release of a GBU-38 Extended Range Joint Direct Attack Munition (JDAM). The trials were sponsored by Boeing / Hawker de Havilland, and required a large cleared range area to allow weapon release without a flight termination system.

2.12 Miniature Munition Trials



The USAF and RAAF jointly undertook miniature munition carriage and release trials using a F-111 bomber at the WTF in June 2004. The program was conducted under the Australia-US Deutch-Ayers Project Arrangement 24, and involved the USAF Air Force Research Laboratory Air Vehicles and Munitions Directorate for aeroacoustics, subsonic and supersonic separations and network enabled concept demonstrators. The test items entailed dual Powered Low Cost Autonomous Attack Systems attached to a subpack and also an ASRAAM for internal carriage.

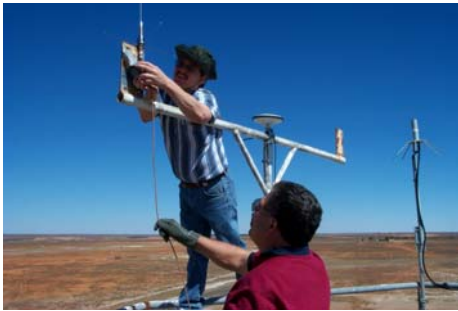
2.13 Bomb Improvement Trials



Bomb improvement trials using two F/A-18 Hornet aircraft operated by the ARDU Flight Test Squadron were undertaken at Woomera in July/August 2006 under project AIR 5409. The aircraft released wing-mounted inert GPS-guided bombs at the Air Weapons Range over the northernmost section of Lake Hart as a preliminary verification measure prior to the subsequent release of live weapons.

The purpose of the trials was to validate the performance of GPS JDAM guidance kits which will transform the RAAF's existing inventory of general purpose and penetrator bombs into "smart bombs" having vastly improved trajectory accuracy.

2.14 GPS Interference Trials



GPS interference trials are undertaken on a regular basis at the WTF by a number of Australian and overseas organisations including the RAAF, the Defence Science and Technology Organisation (DSTO), the Civil Aviation Safety Authority (CASA) and the Air Force Operational Test and Evaluation Center of the United States Air Force (USAF). The WTF is one of the few places in the world where such trials are possible without disrupting civilian GPS users. The purpose of the trials is to assess the vulnerability of GPS signals to interference, and to test counter-measures including the use of GPS Jammer Locators and adaptive signal processing techniques. The trials involve ground and airborne elements, with

aircraft operations being conducted from Woomera Airfield (picture shows antenna mounting on the control tower at Woomera Airfield).

2.15 Parachute Training



Parachute training is undertaken at the WTF by Australian Defence organisations and also by overseas military agencies who take advantage of the restricted airspace, excellent climatic conditions and under-utilised Woomera Airfield (and also Evetts Field at the Woomera Rangehead). For example, in 1998 and 1999, the US Marine Corps conducted an extensive series of parachute training drops (pictured) from C-130 aircraft as part of Exercise Foreconex. The training covered various levels of proficiency, including High Altitude Low Opening (HALO) drops from up to 36,000 feet altitude and at distances of 18 km from the airfield.

2.16 Explosive Trials



Australian and UK Defence organisations have been conducting a series of explosive trials at the Large Scale Explosives Test Area (LSETA) since the mid-1980s (with individual blasts of up to 75 tonnes Net Explosive Quantity). The aim of the trials is to enhance international ammunition storage safety regulations. The trials are managed by the Directorate of Trials (DTRIALS) and involve Australia, the UK, the USA, the Netherlands, Norway and Singapore. Technical control is provided by the UK Ministry of Defence and the Dutch Ministry of Defence.

Trials at LSETA in 2002 involved detonations of 40, 27 and 5 tonnes of high explosives (picture depicts the 27 tonne trial on 20 September 2002). The explosives for the 40 and 27 tonne trials were contained in explosive storehouses constructed to UK standards. Industrial and residential structures, built to meet the needs of the participating countries, were placed strategically around the detonation site to simulate encroaching population. The damage to the structures and the debris distribution were analysed to identify appropriate safety distances for the storage of explosives. Instrumentation around the site measured the blast pressure and a series of 40 cameras collected video images of the blasts.

Recent explosive trials have also involved the detonation of ~5 tonnes of high explosive in shipping containers to simulate an incident during the rail/road transport of explosive ordnance. AOSG has provided photographic and timing control support for all trials.

2.17 Explosive Demolition



In addition to instrumented explosive trials, the WTF is used regularly by military and civilian organisations for the demolition of time-expired munitions and other bulk explosives (eg mining charges). Disposal activities are undertaken at the Lake Hart Demolition Area. Annual demolition activities by the Joint Logistics Command typically entail blasts of several tonnes to 20 tonnes Net Explosive Quantity (NEQ).

2.18 DSTO Trials



DSTO undertakes a wide range of ground and airborne trial activities at the WTF. For example, flights of the USAF Global Hawk Unmanned Aerial Vehicle (UAV) were undertaken over the WTF during May and June 2001 for the purpose of system characterisation, sensor calibration and definition of standard operating procedures.

Other DSTO activities at the WTF include materials testing, Electronic Warfare trials, Explosive Ordnance test and evaluation, rocket guidance system development, testing of tethered balloon radio platforms, optics and surveillance system development, and trials of ground surveillance radars.

2.19 Military Exercises



Various types of military exercises are undertaken within the WTF by elements of the Australian Defence Force and overseas military agencies. Examples include:

- Exercise Rhino Charge in November / December 2002 (pictured) involving 9 Brigade of the Australian Army and entailing the conduct of realistic war games;
- Exercise Kujarra conducted by 160 Squadron of the Republic of Singapore Air Force in 2000, 2004 and 2007, and involving training using Oerlikon 35 mm Twin Anti-Aircraft Guns used in air defence;
- Exercise Precision Red in May 2006 to train RAAF aircrew in preparation for overseas deployment;
- Regular exercises by 1 Airfield Defence Squadron of the RAAF to confirm operational readiness;
- Annual Ground Based Air Defence trials at Lake Hart by 16 Air Defence Regiment and 110/111 Batteries of the Australian Army;
- Garrison Support exercises; and
- Military vehicle driver training exercises.

2.20 PzH 2000 Howitzer Firings



Live firings of 155 mm munitions from an advanced German-designed PzH 2000 self-propelled howitzer were conducted by 14 Field Artillery Battalion of the Netherlands Armed Forces during April 2007. The purpose of the firings was to demonstrate the performance of extended range munitions over distances of up to 40 km, with the impact area being the Lake Hart Air Weapons Range. Night firings of illumine munitions were undertaken, with multiple parachute-borne flares fired in quick succession to illuminate the target area. Day firings of long range high explosive munitions equipped with base burning charges to reduce projectile drag were also successfully completed. The PzH 2000 activities were supported by a Dutch team of ~25 personnel together with staff from AOSG and the Army Proof and Experimental Establishment at Port Wakefield.

3 NON-DEFENCE TRIALS

The following sections present examples of non-Defence trials undertaken at Woomera, typically as commercial activities for international aerospace organisations.

3.1 EXPRESS Re-entry Capsule Mission



The EXPRESS mission was a collaborative program between Germany and Japan and involved the targeted landing of an unmanned re-entry capsule at the WTF. The WTF was selected by the German space agency in view of the large and safe landing area. Approval for the landing was granted by the Australian Government following a comprehensive risk assessment including independent re-entry modelling of the landing footprint. In readiness for the orbital and re-entry phases, the Tjaliri Tracking Station was deployed in the WTF to the west of Coober Pedy. This temporary facility provided a full Tracking, Telemetry and Command capability, and included an Intelsat earth station link to the control centre in Germany.

The Russian-built EXPRESS spacecraft, carrying German and Japanese microgravity and re-entry technology experiments, was launched from the Kagoshima Space Center in Japan on 15 January 1995. However, due to an anomaly with the launch vehicle, the spacecraft was injected into a very low elliptical orbit and re-entered the atmosphere after only 2.5 orbits. While the EXPRESS capsule did not land at the WTF as intended, the Australian support was highly commended and pioneered the approach for future spacecraft re-entry and landing programs at Woomera (refer to Hayabusa mission in [section 3.8](#)).

3.2 ALFLEX Landing Trials



The Japanese Automatic Landing Flight Experiment (ALFLEX) entailed the testing at Woomera Airfield of a one third scale model of the HOPE spaceplane by the National Aerospace Laboratory (NAL) and the National Space Development Agency of Japan (NASDA). The objective was to test the automatic landing technology to be used for HOPE. Selection of Woomera for the ALFLEX program followed a survey by NAL/NASDA of over 100 prospective sites in Japan and overseas.

Instrumentation installed at Woomera Airfield included a microwave landing system, tracking radar, laser tracker, pseudolite DGPS station, weather station and telemetry, command, display and communications equipment. The trials involved the release of the unmanned ALFLEX vehicle from beneath a Japanese twin-rotor helicopter at an altitude of 1500 metres and distance of 3 km from the runway threshold. Following release, the vehicle glided at a descent angle of 30 degrees, guided by on-board navigation and control equipment and by the ground-based microwave landing system.

A total of thirteen automatic landing trials were conducted by NAL/NASDA during 1996 over a range of experimental conditions involving release position, wind direction and programmed in-flight manoeuvres. All trials were spectacularly successful. Refer to [images](#) and [video](#) at the Japan Aerospace Exploration Agency (JAXA) website (NAL and NASDA were merged into JAXA in October 2003).

3.3 SRB Propellant Trials



The WTF was selected by NASDA in conjunction with the Nissan Motor Company for the shock testing of propellant material from the Solid Rocket Boosters (SRBs) used on the Japanese H-IIA satellite launch vehicle. The purpose of the testing was to determine the explosive potential and fragmentation characteristics of the propellant, and in particular, to simulate the high speed impact of unburnt propellant as might occur in the event of a launch accident.

The SRB trials were conducted at the Large Scale Explosives Test Area with the support of Defence and contractor personnel, and involved the high velocity impact of a heavy steel plate on to cylindrical masses of propellant. Acceleration of the 'flyer' plate was achieved using shaped

plastic explosive. An extensive suite of Japanese-supplied instrumentation was installed at the test site, together with ARDU-supplied firing and photographic equipment.

Two successful series of SRB trials were conducted in 1997 and 1998 using propellant masses of 500 kg and 1000 kg. The tests graphically demonstrated the potential of unburnt rocket propellant to explode violently (pictured) in the event of premature impact at high velocity. The SRB trials provided essential data to NASDA for establishing safety criteria at the Tanegashima Space Center in support of H-IIA launch operations (including enhanced reinforcing of protective concrete bunkers).

3.4 Super-Sonic Transport Trials



Following the success of the ALFLEX program, JAXA selected Woomera for the conduct of the National Experimental Supersonic Transport (NEXST) flight trials. The NEXST program involved the rocket-boosted launch of a one tenth scale model un-powered supersonic airplane. The purpose of the trials was to verify the aerodynamic design of a next generation supersonic airliner based on theoretical modelling and wind tunnel testing in Japan.

JAXA undertook significant infrastructure upgrades at the WTF in preparation for the NEXST flights including the installation of a heavy duty launcher and associated air-conditioned

moveable shelter, commissioning of a 100 kW radar Upper-Air Wind Profiler and also improvements to various range facilities.

The first NEXST flight on 14 July 2002 failed due to premature separation of the airplane from the booster. The second flight on 10 October 2005 was spectacularly successful (pictured). Following launch and separation from the booster, the airplane reached an altitude of 19 km and travelled ~100 km down-range at a speed exceeding Mach 2. After completing the aerodynamic measurement phase, the airplane returned autonomously for a perfect parachute and airbag landing approximately 15 km from the launch site. Images and video of the flight are available at [JAXA's Aviation Program Group website](#). Extensive support of the NEXST program was provided by AOSG and Adelaide-based aerospace companies.

The Aviation Program Group of JAXA is currently progressing plans for follow-on flight testing of a powered supersonic airplane known as the [Silent Super-Sonic Technology Demonstrator \(S³TD\)](#).

3.5 NASA Sounding Rocket Trials



NASA sounding rocket trials have been conducted at Woomera on an occasional basis since 1961. The last series, involving solid fuel Terrier-boosted Black Brant rockets, were undertaken in 1987 and 1995 (total of 12 flights). The purpose of the flights was to carry out space-borne astrophysical research including observations of Supernova SN1987a which is best observed from the Southern Hemisphere.

The Black Brant rockets reached altitudes between 250-320 km, and the scientific payloads were recovered by parachute approximately 180-240 km from the launch site. Extensive local support was provided to NASA in the conduct of the trials including use of preparation facilities, range safety tracking and payload recovery.

3.6 HyShot Sounding Rocket Trials



The HyShot program was initiated by the University of Queensland (UQ) for the purpose of testing advanced scramjet hypersonic propulsion. The program entailed the launch of UQ designed scramjet engines on Terrier-Orion sounding rockets provided by DTI Associates. The rockets reached an apogee of over 300 km and a down-range distance of ~400 km.

During the HyShot-2 flight on 30 July 2002, the UQ group achieved the first ever demonstration of in-flight supersonic combustion. Activation of the hydrogen powered scramjet engine occurred during atmospheric re-entry at an altitude of approximately 35 km and a speed of around Mach 7.5. HyShot-2 flight data have been compared with test results obtained using the same scramjet engine in the UQ shock tunnel facility.

Further flights in the HyShot series have been undertaken as Defence trials in collaboration with international partners (refer to [section 2.12](#)). AOSG provided support for the HyShot trials including launch sequencing, radar tracking and safety management. Images and video clips of the HyShot flights are available at UQ's [Centre for Hypersonics website](#).

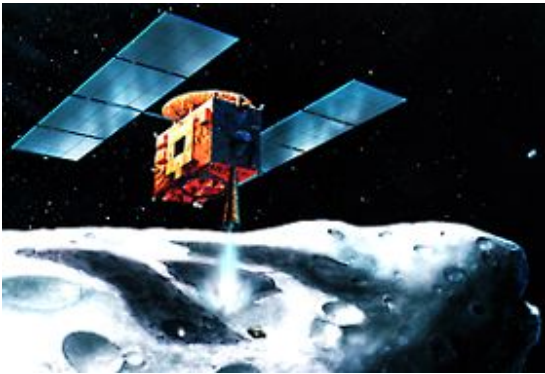
3.7 ASRI Sounding Rocket Trials



The Australian Space Research Institute (ASRI) has conducted numerous sounding rocket trials at Woomera since 1992 including the launch of the ASRI-developed liquid-fuel AUSROC-2, as well as small solid fuel Sighter and Zuni rockets (pictured). The latter rockets, with diameters of 75 mm and 125 mm respectively, reach altitudes of around 5-7 km and are used for experimental and educational purposes under ASRI's Small Sounding Rocket Program. Regular flights are carried out from Launch Area 9 with payloads being constructed by ASRI, research groups and school students.

ASRI is presently developing an upgraded version of the AUSROC-2 liquid fuel rocket and also a new solid fuel sounding rocket (Wagtail) for use at Woomera. Details concerning ASRI's programs can be found at www.asri.org.au.

3.8 Hayabusa Re-entry Capsule Mission



The Hayabusa spacecraft was launched by JAXA's [Institute of Space and Astronautical Science \(ISAS\)](#) on 9 May 2003 from Kagoshima Space Center. The primary purpose of the mission is to rendezvous with a distant asteroid (Itokawa) and return a small sample of primordial material to Earth for scientific analysis. The rendezvous with Itokawa was accomplished with pin-point precision in September 2005 and extensive mapping and sensor measurements were performed. Two touch-down manoeuvres to gather sample material were also undertaken. However, problems were encountered following the final manoeuvre, resulting in the intended landing of the Sample Return Capsule being delayed from mid 2007 to mid 2010.

JAXA has selected the WTF as the landing site for the capsule which will undertake a high speed re-entry from interplanetary space and descend by parachute in a targeted landing area. Advance trials to simulate the capsule landing and location are planned by JAXA. Approval for the landing has been progressed by Australian government entities, including the Space Licensing and Safety Office and Department of Defence.

3.9 Unmanned Aerial Vehicle Trials



The WTF is being used increasingly by Australian and overseas commercial organisations for small and large Unmanned Aerial Vehicle (UAV) trials, operating from either Woomera Airfield or Evetts Field at the Woomera Rangehead. Extensive trials have been conducted using the Australian designed Aerosonde vehicle, with up to six UAVs in the air at the same time. BAE Systems has also performed a number of UAV trials using propeller (eg HERTI) and jet-powered vehicles to test the platforms for surveillance applications. Additionally, Air Target Services and other organisations have conducted UAV trials at the WTF.

The WTF offers a near perfect environment for testing UAVs and evaluating their mission roles given the extensive flight area available and the ability to exclude other aircraft from safety templates. Additionally, the stable desert climate facilitates flying opportunities and the flat terrain enables obstruction-free communications links, usually from tower-mounted antennae (eg Control Tower at Woomera Airfield).

3.10 Vehicle Trials



The WTF is used on a frequent basis by Australian and international car manufacturers for testing pre-release and production vehicles and components (eg by [Test Trak](#)). A variety of sealed & unsealed roads are available that can be used for hot environment (October to March), maximum speed and vehicle dynamics testing as well as a range of calibration tasks. In June 2006 a world-record was set by a Holden production utility (pick-up) which achieved speeds of up to 277 km/hour on the "nine mile" stretch of the range road.

Woomera offers a number of unique advantages for vehicle testing including secure roads and test facilities that are closed to the public, 24 hour / 7 day emergency services (Ambulance, Fire and Rescue), 2.4 km airfield runway for high-speed acceleration trials, full workshop capability, comprehensive communications services and excellent accommodation and restaurant facilities for vehicle teams.

3.11 Astronomical Observations



The remote desert location, extremely dark sky, excellent atmospheric clarity, quiet electromagnetic environment and available support infrastructure renders Woomera as a favourable location for conducting sensitive astronomical observations. The foremost astronomical facility within the WTF is the Cangaroo Gamma-Ray Telescope operated by the Universities of Adelaide and Tokyo. Cangaroo operations commenced in 2000 with a single telescope comprising a 10 metre dish made up of individual parabolic mirror segments and an array of photomultipliers at the focus. The telescope detects faint Cerenkov light resulting from extremely energetic gamma-rays striking the upper atmosphere, producing an 'extensive air shower' of charged particles and photons. The telescope records gamma-rays emitted by violent objects in the universe such as pulsars, black holes, supernova remnants and active galaxies.

Following the success of the initial telescope, three additional telescopes were commissioned at the Cangaroo site in 2004. The four telescopes are linked to provide a large increase in gamma-ray detection sensitivity. Additional details concerning the Cangaroo telescope array can be found at the [University of Adelaide](http://www.adelaide.edu.au/cangaroo/) and [University of Tokyo](http://www.u-tokyo.ac.jp/~cangaroo/) websites.

4 SUMMARY REMARKS

The foregoing sections highlight the extreme versatility of the WTF for undertaking a diverse range of Defence and Commercial ground, air and space programs. Other activities, not specifically referenced above, are also undertaken or are proposed at the WTF including potential satellite launches, high altitude balloon trials, live firings of long-range cruise missiles and testing of Unmanned Combat Aerial Vehicles (UCAVs). Detailed information concerning the attributes of the WTF, available facilities and services, and how to use the WTF are contained in sections 2-7 of the WTF Capability Brief.

The latest version of this document is available for download from the Woomera website at www.woomera.com.au/range/downloads.htm.